CLAIMS

1. A waveguide for use with a dual polarisation waveguide probe system for receiving at least two signals which are orthogonally polarised, said waveguide comprising a waveguide tube into which at least two orthogonally polarised signals are received for transmission therealong, said waveguide having;

a first probe extending from a wall of the waveguide into the interior of the waveguide, said first probe being adapted to receive said orthogonal signal travelling in the same longitudinal plane thereof,

reflector means extending from the wall of the waveguide, through reflector means located downstream of the first probe lying in the longitudinal plane for reflecting signals in said first orthogonal plane back to said first probe means and allowing said signal in said second orthogonal plane to pass along the waveguide, second probe means located downstream of said first reflector means and extending from wall of said waveguide into the interior of the waveguide and lying in said longitudinal plane, signal reflecting and rotating means, including a short circuit at the end of the waveguide, located downstream of said second probe means for receiving, rotating and reflecting said second orthogonally polarised signal back along said waveguide such that the rotated and reflected signal is received by said second probe means, said signal reflecting and rotating means comprising a first reflecting and rotating means in the form of a plate with a leading edge thereon to provide at least one reflecting edge portion for reflecting a first component of said second orthogonally polarised signal, the reflecting edge portion being spaced at a desired distance from the short circuit at the end of the waveguide, a differential phase shift means disposed in proximity to the rotating plate, said differential phase shift means having a slightly asymmetrical cross-section, whereby said first and second

components of said second orthogonally polarised signal are phase shifted with respect to each other in the differential phase shift portion, then reflected respectively from said reflecting edge portion and from said short circuit before being further phase shifted when travelling back through the differential phase shift portion for recombination, said first and second components having different cut-off wavelengths, to provide a recombined signal for detection by said second probe means.

2. A waveguide as claimed in claim 1 wherein said reflecting and rotating means has a single reflecting edge portion across the width of the waveguide.

3. A waveguide as claimed in claim 1 or claim 2 wherein the differential phase shift means is provided by an asymmetric structure in the form of flats cast into the interior of the waveguide structure.

4. A waveguide as claimed in claim 3 wherein two flats are provided on each side, the flats being parallel with and extending along the waveguide from the reflector plate.

5. A waveguide as claimed in claim 1 or claim 2 wherein the slightly asymmetric portion is provided by an elliptical waveguide.

6. A waveguide as claimed in claim 4 wherein the upstream flats are machined a greater distance into the waveguide surface than the downstream flats with the first (downstream) flats forming an impedance matching structure.

7. A waveguide as claimed in claim 3, 4 of 6 wherein the waveguide differential phase shift means is provided by at least two pairs of stepped flats.

8. A waveguide as claimed in claim 1, 2 or 5 wherein the asymmetric portion is provided by a smooth transition along the waveguide.

9. A waveguide as claimed in claim 8 wherein the smooth transition is cast into the side of the waveguide

parallel to the reflecting edge portion.

10. A waveguide as claimed in any preceding claim wherein at least one proturbence is provided on the reflector plate for suppressing any insertion loss glitches which occur within the desired frequency band.

11. A method of receiving at least first and second orthogonally polarised signals in a frequency range in a single waveguide and providing at least two outputs in a common longitudinal plane for providing a flatter characteristic across the frequency range, said method comprising the steps of,

providing a first probe in said waveguide to receive a first orthogonally polarised signal,

providing a reflecting means in said waveguide parallel to and downstream from said first probe for reflecting said first orthogonally polarised signal and for allowing passage of said second orthogonally polarised signal,

providing a second probe in said waveguide parallel to and downstream of said reflector means, said second probe being substantially orthogonal to said second orthogonally polarised signal which passes the second probe without being received by the second probe, providing a signal reflecting and rotating means at the end of the waveguide for reflecting a first component of said second orthogonal signal back towards said second probe,

allowing a second component of said second orthogonal signal to travel towards said waveguide short circuit, modifying the length of said second component such that it has a different cut-off wavelength from said first component,

reflecting said second component from said waveguide short circuit,

recombining said first and second reflected components of said second orthogonal signal to create a recombined reflected signal, said recombined reflected

signal being in the same plane as said second probe for detection thereby, said first and second reflected components having inverse frequency characteristics which combine to create a flatter frequency response across said frequency range.

12. A method as claimed in claim 1 including the step of forming the reflecting and rotating means by combining a differential phase shift section and a reflecting plate.

13. A method as claimed in claim 11 or 12 wherein a phase shift between the first and second portions of the orthogonal signal is introduced by orienting the differential phase shift section at 45° to the incident signal.

14. A method as claimed in any one of claims 10 to 13 including the step of providing proturbences on the twist plate to minimise insertion loss glitches within the frequency band of interest.

15. A dual polarisation waveguide probe structure, said structure having a waveguide, first and second probes disposed in the waveguide separated by a first reflector, said first and second probes and said reflector being disposed in the same plane, second probe signal providing means for providing a polarised component to said second probe, said second probe providing means comprising a signal reflecting and rotating means for reflecting and rotating a polarised component for reception by said second probe, said reflecting and rotating means comprising a reflected edge portion for reflecting a first component of said polarised signal, and a differential phase portion provided by a slightly asymmetrical waveguide portion and a waveguide short circuit for providing a reflected second component with a different cut-off wavelength from said first component, the first and second components having inverse frequency characteristics which when recombined provide a flatter frequency characteristic across the frequency range.

16. A waveguide for use with a dual polarisation

waveguide system for receiving at least two signals which are orthogonally polarised, said waveguide comprising a waveguide tube into which at least two orthogonally polarised signals are received for transmission therealong, said waveguide having;

a first probe extending from a wall of the waveguide into the interior of the waveguide, said first probe being adapted to receive said orthogonal signal travelling in the same longitudinal plane thereof,

reflector means extending from the wall of the waveguide, through reflector means located downstream of the first probe lying in the longitudinal plane for reflecting signals in said first orthogonal plane back to said first probe means and allowing said signal in said second orthogonal plane to pass along the waveguide, second probe means located downstream of said first reflector means and extending from wall of said waveguide into the interior of the waveguide and lying in said longitudinal plane, signal reflecting and rotating means, including a short circuit at the end of the waveguide, located downstream of said second probe means for receiving, rotating and reflecting said second orthogonally polarised signal back along said waveguide such that the rotated and reflected signal is received by said second probe means, said signal reflecting and rotating means also including, a differential phase shift means disposed between the second probe and the short circuit, said differential phase shift means having a slightly asymmetrical cross-section, whereby said first and second components of said second orthogonally polarised signal are phase shifted with respect to each other in the differential phase shift portion, then reflected respectively from said short circuit before being further phase shifted when travelling back through the differential phase shift portion for recombination, said first and second components having different cut-off wavelengths, to provide a recombined signal for detection

by said second probe means.

17. A waveguide as claimed in claim 16 wherein the differential phase shift means is provided by an asymmetric structure in the form of flats cast into the interior of the waveguide structure.

18. A waveguide as claimed in claim 17 wherein two flats are provided on each side, the flats being parallel with and extending along the waveguide from the reflector plate.

19. A waveguide as claimed in claim 16 or 17 wherein the slightly asymmetric portion is provided by an elliptical waveguide.

20. A waveguide as claimed in claim 18 wherein the upstream flats are machined a greater distance into the waveguide surface than the downstream flats with the first (downstream) flats forming an impedance matching structure.

21. A waveguide as claimed in claim 17, 18 or 20 wherein the waveguide differential phase shift means is provided by at least two pairs of stepped flats.

22. A waveguide as claimed in claim 16, 17 or 19 wherein the asymmetric portion is provided by a smooth transition along the waveguide.

23. A waveguide as claimed in claim 22 wherein the smooth transition is cast into the side of the waveguide parallel to the reflecting edge portion.